A

Confutation of Atheism

FROM THE

Origin and Frame of the WORLD.

PART II.

A

SERMON

Preached at

St. *Martin's* in the Fields,

NOVEMBER the 7th. 1692.

Being the *Seventh* of the Lecture Founded by the Honourable *ROBERT BOYLE*, Esquire.

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EDWARD, Lord Bishop of *Worcester.*

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Ra. Barker, R^mo in Chriſto Patri ac D^no D^no *Johanni* Archiep. *Cantuar.* à Sacris Domeſt.

LAMBHITH,
Novemb. 10.
1692.

Acts XIV. 15, &c.

That ye ſhould turn from theſe vanities unto the living God, who made Heaven and Earth and the Sea, and all things that are therein: Who in times paſt ſuffer'd all Nations to walk in their own ways. Nevertheleſs, he left not himſelf without witneſs, in that he did Good, and gave us Rain from Heaven, and fruitfull Seaſons, filling our hearts with Food and Gladneſs.

WHen we firſt enter'd upon this Topic, the demonſtration of God's Exiſtence from the Origin and Frame of the World, we offer'd to prove four Propoſitions.

1. That this preſent Syſtem of Heaven and Earth cannot poſſibly have ſubſiſted from all Eternity.

2. That Matter conſider'd generally, and abſtractly from any particular Form and Concretion, cannot poſſibly have been eternal: Or, if Matter could be ſo; yet Motion cannot have coexiſted with it eternally, as an inherent property and eſſential attribute of Matter. Theſe two we have already eſtabliſhed

in the preceding Diſcourſe; we ſhall now ſhew in the third place,

3. That, though we ſhould allow the Atheiſts, that Matter and Motion may have been from everlaſting; yet if (as they now ſuppoſe) there were once no Sun nor Starrs nor Earth nor Planets; but the Particles, that now conſtitute them, were diffuſed in the mundane Space in manner of a Chaos without any concretion and coalition; thoſe diſperſed Particles could never of themſelves by any kind of Natural motion, whether call'd Fortuitous or Mechanical, have conven'd into this preſent or any other like Frame of Heaven and Earth.

I. And firſt as to that ordinary Cant of illiterate and puny Atheiſts, the *fortuitous or caſual concourſe of Atoms*, that compendious and eaſy Diſpatch of the moſt important and difficult affair, the Formation of a World; (beſides that in our next undertaking it will be refuted all along) I ſhall now briefly diſpatch it, from what hath been formerly ſaid concerning the true notions of Fortune and Chance. Whereby it is evident, that in the Atheiſtical Hypotheſis of the World's production, Fortuitous and Mechanical muſt be the ſelf-ſame thing. Becauſe *Fortune* is no real entity nor phyſical eſſence, but a mere relative ſignification, denoting

Serm. V. p. 6, 7.

noting only this; That ſuch a thing ſaid to fall out by Fortune, was really effected by material and neceſſary Cauſes; but the Perſon, with regard to whom it is called Fortuitous, was ignorant of thoſe Cauſes or their tendencies, and did not deſign nor foreſee ſuch an effect. This is the only allowable and genuine notion of the word Fortune. But thus to affirm, that the World was made *fortuitouſly*, is as much as to ſay, That before the World was made, there was ſome Intelligent Agent or Spectator; who deſigning to do ſomething elſe, or expecting that ſomething elſe would be done with the Materials of the World, there were ſome occult and unknown motions and tendencies in Matter, which mechanically formed the World beſide his deſign or expectation. Now the Atheiſts, we may preſume, will be loth to aſſert a fortuitous Formation in this proper ſenſe and meaning; whereby they will make Underſtanding to be older than Heaven and Earth. Or if they ſhould ſo aſſert it; yet, unleſs they will affirm that the Intelligent Agent did diſpoſe and direct the inanimate Matter, (which is what we would bring them to) they muſt ſtill leave their Atoms to their mechanical Affections; not able to make one ſtep toward the production

duction of a World beyond the neceſſary Laws of Motion. It is plain then, that *Fortune*, as to the matter before us, is but a ſynonymous word with Nature and Neceſſity. It remains that we examin the adequate meaning of *Chance*; which properly ſignifies, That all events called Caſual, among inanimate Bodies, are mechanically and naturally produced according to the determinate figures and textures and motions of thoſe Bodies; with this negation only, That thoſe inanimate Bodies are not conſcious of their own operations, nor contrive and caſt about how to bring ſuch events to paſs. So that thus to ſay, that the World was made *caſually* by the concourſe of Atoms, is no more than to affirm, that the Atoms compoſed the World mechanically and fatally; only they were not ſenſible of it, nor ſtudied and conſider'd about ſo noble an undertaking. For if Atoms formed the World according to the eſſential properties of Bulk, Figure and Motion, they formed it *mechanically*; and if they formed it mechanically without perception and deſign, they formed it *caſually*. So that this negation of Conſciouſneſs being all that the notion of Chance can add to that of Mechaniſm; We, that do not diſpute this matter with the Atheiſts,

Serm. V. p. 12, 13.

iſts, nor believe that Atoms ever acted by Counſel and Thought, may have leave to conſider the ſeveral names of *Fortune* and *Chance* and *Nature* and *Mechaniſm*, as one and the ſame Hypotheſis. Wherefore once for all to overthrow all poſſible Explications which Atheiſts have or may aſſign for the formation of the World, we will undertake to evince this following Propoſition:

II. That the Atoms or Particles which now conſtitute Heaven and Earth, being once ſeparate and diffuſed in the Mundane Space, like the ſuppoſed *Chaos*, could never *without a God by their Mechanical affections* have convened into this preſent Frame of Things or any other like it.

Which that we may perform with the greater clearneſs and conviction; it will be neceſſary, in a diſcourſe about the Formation of the World, to give you a brief account of ſome of the moſt principal and ſyſtematical *Phænomena*, that occurr in the World now that it is formed.

(1.) The moſt conſiderable *Phænomenon* belonging to Terreſtrial Bodies is the general action of *Gravitation*, whereby All known Bodies in the vicinity of the Earth do tend and preſs toward its Center; not only ſuch as are ſenſibly

ſenſibly and evidently Heavy, but even thoſe that are comparatively the Lighter, and even in their proper place, and natural Elements, (as they uſually ſpeak) as Air gravitates even in Air and Water in Water. This hath been demonſtrated and experimentally proved beyond contradiction, by ſeveral ingenious Perſons of the preſent Age, but by none ſo perſpicuouſly and copiouſly and accurately, as by the Honourable Founder of this Lecture in his incomparable Treatiſes of the *Air* and *Hydroſtaticks*.

Mr. *Boyle's* Phyſi-com. Exp. of Air. Hydro-ſtat. Paradoxes.

(2.) Now this is the conſtant Property of *Gravitation*; That the weight of all Bodies around the Earth is ever proportional to the Quantity of their Matter: As for inſtance, a Pound weight (examin'd Hydroſtatically) of all kinds of Bodies, though of the moſt different forms and textures, doth always contain an equal quantity of ſolid Maſs or corporeal Subſtance. This is the ancient Doctrine of the *Epicurean* Phyſiology, then and ſince very probably indeed, but yet precariouſly aſſerted: But it is lately demonſtrated and put beyond controverſy by that very excellent and divine Theoriſt Mr. *Iſaac Newton*, to whoſe moſt admirable ſagacity and induſtry we ſhall frequently be obliged in this and the following Diſcourſe.

Lucret. lib. 1.

Newton Philoſ. Natur. Princ. Math. lib. 3. prop. 6.

I will not entertain this Auditory with an account of the Demonſtration; but referring the Curious to the Book it ſelf for full ſatisfaction, I ſhall now proceed and build upon it as a Truth ſolidly eſtabliſhed, *That all Bodies weigh according to their Matter*; provided only that the compared Bodies be at equal diſtances from the Center toward which they weigh. Becauſe the further they are removed from the Center, the lighter they are: decreaſing gradually and uniformly in weight, in a duplicate proportion to the Increaſe of the Diſtance.

(3.) Now ſince Gravity is found proportional to the Quantity of Matter, there is a manifeſt Neceſſity of admitting a *Vacuum*, another principal Doctrine of the *Atomical* Philoſophy. Becauſe if there were every-where an abſolute plenitude and denſity without any empty pores and interſtices between the Particles of Bodies, then all Bodies of equal dimenſions would contain an equal Quantity of Matter; and conſequently, as we have ſhewed before, would be equally ponderous: ſo that Gold, Copper, Stone, Wood, *&c.* would have all the ſame ſpecifick weight; which Experience aſſures us they have not: neither would any of them deſcend in the Air, as we all ſee they do; becauſe, if all Space was Full, even the Air would be as denſe and ſpecifically as

heavy as they. If it be ſaid, that, though the difference of ſpecifick Gravity may proceed from variety of Texture, the lighter Bodies being of a more looſe and porous compoſition, and the heavier more denſe and compact; yet an æthereal ſubtile Matter, which is in a perpetual motion, may penetrate and pervade the minuteſt and inmoſt Cavities of the cloſeſt Bodies, and adapting it ſelf to the figure of every Pore, may adequately fill them; and ſo prevent all Vacuity, without increaſing the weight: To this we anſwer; That that ſubtile Matter it ſelf muſt be of the ſame Subſtance and Nature with all other Matter, and therefore It alſo muſt weigh proportionally to its Bulk; and as much of it as at any time is comprehended within the Pores of a particular Body muſt gravitate jointly with that Body: ſo that if the Preſence of this æthereal Matter made an abſolute Fullneſs, all Bodies of equal dimenſions would be equally heavy: which being refuted by experience, it neceſſarily follows, that there is a Vacuity; and that (notwithſtanding ſome little objections full of cavil and ſophiſtry) mere and ſimple Extenſion or Space hath a quite different nature and notion from real Body and impenetrable Subſtance.

(4.) This

(4.) This therefore being eſtabliſhed; in the next place it's of great conſequence to our preſent enquiry, if we can make a computation, How great is the whole Summ of the Void ſpaces in our ſyſtem, and what proportion it bears to the corporeal ſubſtance. By many and accurate Trials it manifeſtly appears, that Refined Gold, the moſt ponderous of known Bodies, (though even that muſt be allowed to be porous too, being diſſoluble in *Mercury* and *Aqua Regis* and other Chymical Liquors; and being naturally a thing impoſſible, that the Figures and Sizes of its conſtituent Particles ſhould be ſo juſtly adapted, as to touch one another in every Point,) I ſay, Gold is in ſpecifick weight to common Water as 19 to 1; and Water to common Air as 850 to 1: ſo that Gold is to Air as 16150 to 1. Whence it clearly appears, ſeeing Matter and Gravity are always commenſurate, that (though we ſhould allow the texture of Gold to be intirely cloſe without any vacuity) the ordinary Air in which we live and reſpire is of ſo thin a compoſition, that 16149 parts of its dimenſions are mere emptineſs and Nothing; and the remaining One only material and real ſubſtance. But if Gold it ſelf be admitted, as it muſt be, for a porous Concrete, the proportion of Void to Body in the texture of common Air will be ſo much the greater.

Mr. *Boyle* of Air and Porosity of Bodies.

And thus it is in the loweſt and denſeſt region of the Air near the ſurface of the Earth, where the whole Maſs of Air is in a ſtate of violent compreſſion, the inferior being preſs'd and conſtipated by the weight of all the incumbent. But, ſince the Air is now certainly known to conſiſt of elaſtick or ſpringy Particles, that have a continual tendency and endeavour to expand and diſplay themſelves; and the dimenſions, to which they expand themſelves, to be reciprocally as the Compreſſion; it follows, that the higher you aſcend in it, where it is leſs and leſs compreſs'd by the ſuperior Air, the more and more it is rarefied. So that at the hight of a few miles from the ſurface of the Earth, it is computed to have ſome million parts of empty ſpace in its texture for one of ſolid Matter. And at the hight of one Terreſtrial Semid. (not above 4000 miles) the Æther is of that wonderfull tenuity, that by an exact calculation, if a ſmall Sphere of common Air of one Inch Diameter (already 16149 parts Nothing) ſhould be further expanded to the thinneſs of that Æther, it would more than take up the Vaſt Orb of *Saturn*, which is many million million times bigger than the whole Globe of the Earth. And yet the higher you aſcend above that region, the Rarefaction ſtill gradually increaſes without ſtop or limit: ſo that,

Mr. *Boyle* ibid.

Newton Philoſ. Nat. Principia. Math. p. 503.

that, in a word, the whole Concave of the Firmament, except the Sun and Planets and their Atmoſpheres, may be conſider'd as a mere Void. Let us allow then, that all the Matter of the Syſtem of our Sun may be 50000 times as much as the whole Maſs of the Earth; and we appeal to Aſtronomy, if we are not liberal enough and even prodigal in this conceſſion. And let us ſuppoſe further, that the whole Globe of the Earth is intirely ſolid and compact without any void interſtices; notwithſtanding what hath been ſhewed before, as to the texture of Gold it ſelf. Now though we have made ſuch ample allowances; we ſhall find, notwithſtanding, that the void Space of our Syſtem is immenſly bigger than all its corporeal Maſs. For, to proceed upon our ſuppoſition, that all the Matter within the Firmament is 50000 times bigger than the ſolid Globe of the Earth; if we aſſume the Diameter of the *Orbis Magnus* (wherein the Earth moves about the Sun) to be only 7000 times as big as the Diameter of the Earth (though the lateſt and moſt accurate Obſervations make it thrice 7000) and the Diameter of the Firmament to be only 100000 times as long as the Diameter of the *Orbis Magnus* (though it cannot poſſibly be leſs than that, but may be vaſtly and unſpeakably bigger) we muſt pronounce, after ſuch large conceſſions

on

on that ſide and ſuch great abatements on ours, That the Summ of Empty Spaces within the Concave of the Firmament is 6860 million million million times bigger than All the Matter contain'd in it.

Now from hence we are enabled to form a right conception and imagination of the ſuppoſed Chaos; and then we may proceed to determin the controverſy with more certainty and ſatisfaction; whether a World like the Preſent could poſſibly without a Divine Influence be formed in it or no?

(1.) And *firſt*, becauſe every Fixt Star is ſuppoſed by Aſtronomers to be of the ſame Nature with our Sun; and each may very poſſibly have Planets about them, though by reaſon of their vaſt diſtance they be inviſible to Us: we will aſſume this reaſonable ſuppoſition, That the ſame proportion of Void Space to Matter, which is found in our Sun's Region within the Sphere of the Fixt Starrs, may competently well hold in the whole Mundane Space. I am aware, that in this computation we muſt not aſſign the whole Capacity of that Sphere for the Region of our Sun; but allow half of its Diameter for the *Radii* of the ſeveral Regions of the next Fixt Starrs. So that diminiſhing our former number, as this laſt conſideration requires; we may ſafely affirm from certain

tain and demonſtrated Principles, That the empty Space of our Solar Region (comprehending half of the Diameter of the Firmament) is 8575 hundred thouſand million million times more ample than all the corporeal ſubſtance in it. And we may fairly ſuppoſe, that the ſame proportion may hold through the whole Extent of the Univerſe.

(2.) And *ſecondly* as to the ſtate or condition of Matter before the World was a-making, which is compendiouſly expreſt by the word *Chaos*; they muſt ſuppoſe, that either All the Matter of our Syſtem was *evenly* or well-nigh evenly diffuſed through the Region of the Sun, this would repreſent a particular Chaos: or All Matter univerſally ſo ſpread through the whole Mundane Space; which would truly exhibit a General Chaos; no part of the Univerſe being rarer or denſer than another. Which is agreeable to the ancient Deſcription of it, That * *the Heavens and Earth had* μίαν ἰδέαν, μίαν μορφήν, *one form*, one texture and conſtitution: which could not be, unleſs all the Mundane Matter were *uniformly* and evenly diffuſed. 'Tis indifferent to our Diſpute, whether they ſuppoſe it to have continued a long time or very little in the ſtate of Diffuſion. For if there

* Diod. Sicul. lib. 1. Καὶ τὴν μὲν ἀρχὰς τῶν ὅλων συστάσιν μίαν ἔχειν ἰδέαν οὐρανόν τε καὶ γῆν, μεμιγμένης αὐτῶν τῆς φύσεως. Apoll. Rhodius lib. 1. Ἦεν δ' ὡς γαῖα καὶ οὐρανὸς ἠδὲ θάλασσα, τὸ πρὶν ἐπ' ἀλλήλοισι μιῇ συναρηρότα μορφῇ.

there was but one ſingle Moment in all paſt Eternity, when Matter was ſo diffuſed: we ſhall plainly and fully prove, that it could never have convened afterwards into the preſent Frame and Order of Things.

(3.) It is evident from what we have newly proved, that in the Suppoſition of ſuch a Chaos or ſuch an even diffuſion either of the whole Mundane Matter or that of our Syſtem (for it matters not which they aſſume) every ſingle Particle would have a Sphere of Void Space around it 8575 hundred thouſand million million times bigger than the dimenſions of that Particle. Nay further, though the proportion already appear ſo immenſe; yet every ſingle Particle would really be ſurrounded with a Void ſphere Eight times as capacious as that newly mention'd; its Diameter being compounded of the Diameter of the Proper ſphere, and the Semi-diameters of the contiguous Spheres of the neighbouring Particles. From whence it appears, that every Particle (ſuppoſing them globular or not very oblong) would be above Nine Million times their own length from any other Particle. And moreover in the whole Surface of this Void ſphere there can only Twelve Particles be *evenly* placed (as the Hypotheſis requires) that is, at equal Diſtances from the Central one and each other. So that

if the Matter of our Syſtem or of the Univerſe was equally diſperſed, like the ſuppoſed Chaos; the reſult and iſſue would be, not only that every Atom would be many Million times its own length diſtant from any other: but if any One ſhould be moved Mechanically (without direction or attraction) to the limit of that diſtance; 'tis above a hundred million millions Odds to an unit, that it would not ſtrike upon any other Atom, but glide through an empty interval without any contact.

(4.) 'Tis true, that while I calculate theſe Meaſures, I ſuppoſe all the Particles of Matter to be at abſolute reſt among themſelves, and ſituated in an exact and mathematical evenneſs; neither of which is likely to be allowed by our Adverſaries, who not admitting the former, but aſſerting the eternity of Motion, will conſequently deny the latter alſo: becauſe in the very moment that Motion is admitted in the Chaos, ſuch an exact evenneſs cannot poſſibly be preſerved. But this I do, not to draw any argument againſt them from the Univerſal Reſt or accurately equal diffuſion of Matter; but only that I may better demonſtrate the great Rarity and Tenuity of their imaginary Chaos, and reduce it to computation. Which computation will hold with exactneſs enough, though we allow the Parti-

cles of the Chaos to be variouſly moved, and to differ ſomething in ſize and figure and ſituation. For if ſome Particles ſhould approach nearer each other than in the former Proportion; with reſpect to ſome other Particles they would be as much remoter. So that notwithſtanding a ſmall diverſity of their Poſitions and Diſtances, the whole Aggregate of Matter, as long as it retain'd the name and nature of Chaos, would retain well-nigh an uniform tenuity of Texture, and may be conſider'd as an homogeneous Fluid. As ſeveral Portions of the ſame ſort of Water are reckon'd to be of the ſame ſpecifick gravity; though it be naturally impoſſible that every Particle and Pore of it, conſider'd Geometrically, ſhould have equal ſizes and dimenſions.

We have now repreſented the true ſcheme and condition of the Chaos; how all the Particles would be diſunited; and what vaſt intervals of empty Space would lye between each. To form a Syſtem therefore, 'tis neceſſary that theſe ſquander'd Atoms ſhould convene and unite into great and compact Maſſes, like the Bodies of the Earth and Planets. Without ſuch a coalition the diffuſed Chaos muſt have continued and reign'd to all eternity. But how could Particles ſo widely diſperſed combine into that cloſeneſs of Texture? Our Adverſa-

ries can have only theſe two ways of accounting for it. *Either* by the Common Motion of Matter, proceeding from external Impulſe and Conflict (without attraction) by which every Body moves uniformly in a direct line according to the determination of the impelling force. For, they may ſay, the Atoms of the Chaos being variouſly moved according to this catholic Law, muſt needs knock and interfere; by which means ſome that have convenient figures for mutual coherence might chance to ſtick together, and others might join to thoſe, and ſo by degrees ſuch huge Maſſes might be formed, as afterwards became Suns and Planets: or there might ariſe ſome vertiginous Motions or Whirlpools in the Matter of the Chaos; whereby the Atoms might be thruſt and crowded to the middle of thoſe Whirlpools, and there conſtipate one another into great ſolid Globes, ſuch as now appear in the World. Or *ſecondly* by mutual Gravitation or Attraction. For they may aſſert, that Matter hath inherently and eſſentially ſuch an intrinſeck energy, whereby it inceſſantly tends to unite it ſelf to all other Matter: ſo that ſeveral Particles placed in a Void ſpace at any diſtance whatſoever would without any external impulſe ſpontaneouſly convene and unite together. And thus the Atoms of the Chaos,

though never ſo widely diffuſed, might by this innate property of Attraction ſoon aſſemble themſelves into great ſpherical Maſſes, and conſtitute Syſtems like the preſent Heaven and Earth. This is all that can be propoſed by Atheiſts, as an efficient cauſe of a World. For as to the *Epicurean* Theory, of Atoms deſcending down an infinite ſpace by an inherent principle of Gravitation, which tends not toward other Matter, but toward a *Vacuum* or Nothing; and verging from the Perpendicular * *no body knows why nor when nor where*; 'tis ſuch miſerable abſurd ſtuff, ſo repugnant to it ſelf, and ſo contrary to the known Phænomena of Nature (yet it contented ſupine unthinking Atheiſts for a thouſand years together) that we will not now honour it with a ſpecial refutation. But what it hath common with the other Explications, we will fully confute together with Them in theſe three Propoſitions.

* Lucret. *Nec regione loci certa, nec tempore certo.*

(1.) That by Common Motion (without attraction) the diſſever'd Particles of the Chaos could never make the World; could never convene into ſuch great compact Maſſes, as the Planets now are; nor either acquire or continue ſuch Motions, as the Planets now have.

(2.) That ſuch a mutual Gravitation or ſpontaneous Attraction can neither be inherent and eſſential to Matter; nor ever ſupervene to it, unleſs

unleſs impreſs'd and infuſed into it by a Divine Power.

(3.) That though we ſhould allow ſuch Attraction to be natural and eſſential to all Matter; yet the Atoms of a Chaos could never ſo convene by it, as to form the preſent Syſtem: or if they could form it, it could neither acquire ſuch Motions, nor continue permanent in this ſtate, without the Power and Providence of a Divine Being.

I. And firſt, that by Common Motion the Matter of Chaos could never convene into ſuch Maſſes, as the Planets now are. Any man, that conſiders the ſpacious void Intervals of the Chaos, how immenſe they are in proportion to the bulk of the Atoms, will hardly induce himſelf to believe, that Particles ſo widely diſſeminated could ever throng and crowd one another into a cloſe and compact texture. He will rather conclude, that thoſe few that ſhould happen to claſh, might rebound after the colliſion; or if they cohered, yet by the next conflict with other Atoms might be ſeparated again, and ſo on in an eternal viciſſitude of Faſt and Looſe, without ever conſociating into the huge condenſe Bodies of Planets; ſome of whoſe Particles upon this ſuppoſition muſt have travell'd many millions of Leagues through the gloomy regions of Chaos,

os, to place themſelves where they now are. But then how rarely would there be any claſhing at all? how very rarely in compariſon to the number of Atoms? The whole multitude of them, generally ſpeaking, might freely move and rove for ever with very little occurring or interfering. Let us conceive two of the neareſt Particles according to our former Calculation; or rather let us try the ſame proportions in another Example, that will come eaſier to the Imagination. Let us ſuppoſe two Ships, fitted with durable Timber and Rigging, but without Pilot or Mariners, to be placed in the vaſt *Atlantick* or the *Pacifique* Ocean, as far aſunder as may be. How many thouſand years might expire, before thoſe ſolitary Veſſels ſhould happen to ſtrike one againſt the other? But let us imagin the Space yet more ample, even the whole face of the Earth to be covered with Sea, and the two Ships to be placed in the oppoſite Poles: might not they now move long enough without any danger of claſhing? And yet I find, that the two neareſt Atoms in our evenly diffuſed Chaos have ten thouſand times leſs proportion to the two Void circular Planes around them, than our two Ships would have to the whole Surface of the Deluge. Let us aſſume then another Deluge ten thouſand times larger than *Noah*'s. Is it not now utterly incredible,

credible, that our two Veſſels, placed there Antipodes to each other, ſhould ever happen to concur? And yet let me add, that the Ships would move in one and the ſame Surface; and conſequently muſt needs encounter, when they either advance towards one another in direct lines, or meet in the interſection of croſs ones; but the Atoms may not only fly ſide-ways, but over likewiſe and under each other: which makes it many million times more improbable, that they ſhould interfere than the Ships, even in the laſt and unlikelieſt inſtance. But they may ſay, Though the Odds indeed be unſpeakable that the Atoms do not convene in any ſet number of Trials, yet in an infinite Succeſſion of them may not ſuch a Combination poſſibly happen? But let them conſider, that the improbability of Caſual Hits is never diminiſhed by repetition of Trials; they are as unlikely to fall out at the Thouſandth as at the Firſt. So that in a matter of mere Chance, when there is ſo many Millions odds againſt any aſſignable Experiment; 'tis in vain to expect it ſhould ever ſucceed, even in endleſs Duration. Serm. V. p. 32.

But though we ſhould concede it to be ſimply poſſible, that the Matter of Chaos might convene into great Maſſes, like Planets: yet it's abſolutely impoſſible, that thoſe Maſſes ſhould *acquire* ſuch revolutions about the Sun. Let us

us ſuppoſe any one of thoſe Maſſes to be the Preſent Earth. Now the annual Revolution of the Earth muſt proceed (in this Hypotheſis) *either* from the Summ and Reſult of the ſeveral motions of all the Particles that formed the Earth, *or* from a new Impulſe from ſome external Matter, after it was formed. The *former* is apparently abſurd, becauſe the Particles that form'd the round Earth muſt needs convene from all points and quarters toward the middle, and would generally tend toward its Center; which would make the whole Compound to reſt in a Poiſe: or at leaſt that overplus of Motion, which the Particles of one Hemiſphere could have above the other, would be very ſmall and inconſiderable; too feeble and languid to propell ſo vaſt and ponderous a Body with that prodigious velocity. And *ſecondly*, 'tis impoſſible, that any external Matter ſhould impell that compound Maſs, after it was formed. 'Tis manifeſt, that nothing elſe could impell it, unleſs the Æthereal Matter be ſuppoſed to be carried about the Sun like a *Vortex* or Whirlpool, as a Vehicle to convey It and the reſt of the Planets. But this is refuted from what we have ſhewn above, that thoſe Spaces of the Æther may be reckon'd a mere Void, the whole Quantity of their Matter ſcarce amounting to the weight of a Grain. 'Tis refuted alſo from

from Matter of Fact in the Motion of Comets; which, as often as they are viſible to Us, are in the Region of our Planets; and there are obſerved to move, ſome in quite contrary courſes to Theirs, and ſome in croſs and oblique ones, in Planes inclined to the Plane of the Ecliptick in all kinds of Angles: which firmly evinces, that the Regions of the Æther are empty and free, and neither reſiſt nor aſſiſt the Revolutions of Planets. But moreover there could not poſſibly ariſe in the Chaos any *Vortices* or Whirlpools at all; either to form the Globes of the Planets, or to revolve them when formed. 'Tis acknowledged by all, that inanimate unactive Matter moves always in a ſtreight Line, nor ever reflects in an Angle, nor bends in a Circle (which is a continual reflexion) unleſs *either* by ſome external Impulſe, that may divert it from the direct motion, *or* by an intrinſec Principle of Gravity or Attraction, that may make it deſcribe a curve line about the attracting Body. But this latter Cauſe is not now ſuppoſed: and the former could never beget Whirlpools in a Chaos of ſo great a Laxity and Thinneſs. For 'tis matter of certain experience and univerſally allowed, that all Bodies moved circularly have a perpetual endeavour to recede from the Center, and every moment would fly out in right Lines, if they were

Newton ibidem p. 480.

not violently reſtrain'd and kept in by contiguous Matter. But there is no ſuch reſtraint in a Chaos, no want of empty room there; no poſſibility of effecting one ſingle Revolution in way of a *Vortex*, which neceſſarily requires either an abſolute Fulneſs of Matter, or a pretty cloſe Conſtipation and mutual Contact of its Particles.

And for the ſame reaſon 'tis evident, that the Planets could not *continue* their Revolutions about the Sun; though they could poſſibly acquire them. For to drive and carry the Planets in ſuch Orbs as they now deſcribe, that Æthereal Matter muſt be compact and denſe, as denſe as the very Planets themſelves: otherwiſe they would certainly fly out in Spiral Lines to the very circumference of the *Vortex*. But we have often inculcated, that the wide Tracts of the Æther may be reputed as a mere extended Void. So that there is nothing (in this Hypotheſis) that can retain and bind the Planets in their Orbs for one ſingle moment; but they would immediately deſert them and the neighbourhood of the Sun, and vaniſh away in Tangents to their ſeveral Circles into the Abyſs of Mundane Space.

II. Secondly we affirm, that mutual Gravitation or ſpontaneous Attraction cannot poſſibly be innate and eſſential to Matter. By Attraction

traction we do not here underſtand what is improperly, though vulgarly, called ſo, in the operations of drawing, ſucking, pumping, *&c.* which is really Pulſion and Truſion; and belongs to that Common Motion, which we have already ſhewn to be inſufficient for the formation of a World. But we now mean (as we have explain'd it before) ſuch a power and quality, whereby all parcels of Matter would mutually attract or mutually tend and preſs to all others; ſo that (for inſtance) two diſtant Atoms *in vacuo* would ſpontaneouſly convene together without the impulſe of external Bodies. Now we ſay, if our Atheiſts ſuppoſe this power to be inherent and eſſential to Matter; they overthrow their own Hypotheſis: there could never be a Chaos at all upon theſe terms, but the preſent form of our Syſtem muſt have continued from all Eternity; againſt their own Suppoſition, and what we have proved in our Laſt. For if they affirm, that there might be a Chaos notwithſtanding innate Gravity; then let them aſſign any Period though never ſo remote, when the diffuſed Matter might convene. They muſt confeſs, that before that aſſigned Period Matter had exiſted eternally, inſeparably endued with this principle of Attraction; and yet had never attracted nor convened before, during that infinite duration: which is

Vide Serm. VI. & Serm. VIII.

ſo monſtrous an abſurdity, as even They will bluſh to be charged with. But ſome perhaps may imagin, that a former Syſtem might be diſſolved and reduced to a Chaos, from which the preſent Syſtem might have its Original, as that Former had from another, and ſo on: new Syſtems having grown out of old ones in infinite Viciſſitudes from all paſt eternity. But we ſay, that in the Suppoſition of innate Gravity no Syſtem at all could be diſſolved. For how is it poſſible, that the Matter of ſolid Maſſes like Earth and Planets and Starrs ſhould fly up from their Centers againſt its inherent principle of mutual Attraction, and diffuſe it ſelf in a Chaos? This is abſurder than the other: That only ſuppoſed innate Gravity not to be exerted; This makes it to be defeated, and to act contrary to its own Nature. So that upon all accounts this eſſential power of Gravitation or Attraction is irreconcilable with the Atheiſt's own Doctrine of a Chaos. And ſecondly 'tis repugnant to Common Senſe and Reaſon. 'Tis utterly unconceivable, that inanimate brute Matter (without the mediation of ſome Immaterial Being) ſhould operate upon and affect other Matter without mutual Contact; that diſtant Bodies ſhould act upon each other through a *Vacuum* without the intervention of ſomething elſe by and through which the

the action may be conveyed from one to the other. We will not obſcure and perplex with multitude of words, what is ſo clear and evident by its own light, and muſt needs be allowed by all, that have any competent uſe of Thinking, and are initiated into, I do not ſay the Myſteries, but the plaineſt Principles of Philoſophy. Now mutual Gravitation or Attraction (in our preſent acception of the Words) is the ſame thing with This; 'tis an operation or vertue or influence of diſtant Bodies upon each other through an empty Interval, without any *Effluvia* or Exhalations or other corporeal Medium to convey and tranſmit it. This Power therefore cannot be innate and eſſential to Matter. And if it be not eſſential; it is conſequently moſt manifeſt (ſeeing it doth not depend upon Motion or Reſt or Figure or Poſition of Parts, which are all the ways that Matter can diverſify it ſelf) that it could never *ſupervene* to it, unleſs impreſs'd and infuſed into it by an immaterial and divine Power.

We have proved, that a Power of mutual Gravitation, without contact or impulſe, can in no-wiſe be attributed to mere Matter: or if it could; we ſhall preſently ſhew, that it would be wholly unable to form the World out of *Chaos*. But by the way; what if it be made appear, that there is really ſuch a Power of Gravity

Gravity perpetually acting in the conſtitution of the preſent Syſtem? This would be a new and invincible Argument for the Being of God: being a direct and poſitive proof, that an immaterial living Mind doth inform and actuate the dead Matter, and ſupport the Frame of the World. I will lay before you ſome certain *Phænomena* of Nature; and leave it to your conſideration from what Principle they can proceed. 'Tis demonſtrated, That the Sun, Moon and all the Planets do reciprocally gravitate one toward another: that the Gravitating power of each of Theſe is exactly proportional to their Matter, and ariſes from the ſeveral Gravitations or Attractions of every individual Particle that compoſe the whole Maſs: that all Matter near the Surface of the Earth, for example, doth not only gravitate downwards, but upwards alſo and ſide-ways and toward all imaginable Points; though the Tendency downwards be prædominant and alone diſcernible, becauſe of the Greatneſs and Nearneſs of the attracting Body, the Earth: that every Particle of the whole Syſtem doth attract and is attracted by all the reſt, All operating upon All: that this *Univerſal Attraction or Gravitation* is an inceſſant, regular and uniform Action by certain and eſtabliſhed Laws according to Quantity of Matter and Longitude of Diſtance:

Diſtance: that it cannot be deſtroyed nor impair'd nor augmented by any thing, neither by Motion nor Reſt, nor Situation nor Poſture, nor alteration of Form, nor diverſity of Medium: that it is not a Magnetical Power, nor the effect of a Vortical Motion; thoſe common attempts toward the Explication of Gravity: Theſe things, I ſay, are fully demonſtrated, as matters of Fact, by that very ingenious Author, whom we cited before. Now how is it poſſible that theſe things ſhould be effected by any Material and Mechanical Agent? We have evinced, that mere Matter cannot operate upon Matter without mutual Contact. It remains then, that theſe Phænomena are produced *either* by the intervention of Air or Æther or other ſuch medium, that communicates the Impulſe from one Body to another; *or* by Effluvia and Spirits that are emitted from the one, and pervene to the other. We can conceive no other way of performing them Mechanically. But what impulſe or agitation can be propagated through the Æther from one Particle entombed and wedged in the very Center of the Earth to another in the Center of *Saturn*? Yet even thoſe two Particles do reciprocally affect each other with the ſame force and vigour, as they would do at the ſame diſtance in any other Situation imaginable. And becauſe the

Newton Philoſophiæ Naturalis Princ. Math. lib. III.

the Impulſe from this Particle is not directed to That only; but to all the reſt in the Univerſe, to all quatters and regions, at once invariably and inceſſantly: to do this mechanically; the ſame phyſical Point of Matter muſt move all manner of ways equally and conſtantly in the ſame inſtant and moment; which is flatly impoſſible. But if this Particle cannot propagate Motion; much leſs can it ſend out Effluvia to all points without intermiſſion or variation; ſuch multitudes of Effluvia as to lay hold on every Atom in the Univerſe without miſſing of one. Nay every ſingle Particle of the very Effluvia (ſeeing they alſo attract and gravitate) muſt in this Suppoſition emit other ſecondary Effluvia all the World over; and thoſe others ſtill emit more, and ſo *in infinitum.* Now if theſe things be repugnant to human reaſon; we have great reaſon to affirm, That Univerſal Gravitation, a thing certainly exiſtent in Nature, is above all Mechaniſm and material Cauſes, and proceeds from a higher principle, a Divine energy and impreſſion.

III. Thirdly we affirm; That, though we ſhould allow, that reciprocal Attraction is eſſential to Matter; yet the Atoms of a Chaos could never ſo convene by it, as to form the preſent Syſtem; or if they could form it, yet it could neither acquire theſe Revolutions, nor ſubſiſt

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in the preſent condition, without the Conſervation and Providence of a Divine Being.

(1.) For firſt, if the Matter of the Univerſe, and conſequently the Space through which it's diffuſed, be ſuppoſed to be *Finite* (and I think it might be demonſtrated to be ſo; but that we have already exceeded the juſt meaſures of a Sermon) then, ſince every ſingle Particle hath an innate Gravitation toward all others, proportionated by Matter and Diſtance: it evidently appears, that the outward Atoms of the Chaos would neceſſarily tend inwards and deſcend from all quarters toward the Middle of the whole Space (for in reſpect to every Atom there would lie through the Middle the greateſt quantity of Matter and the moſt vigorous Attraction) and would there form and conſtitute one huge ſphærical Maſs; which would be the only Body in the Univerſe. It is plain therefore, that upon this Suppoſition the Matter of the Chaos could never compoſe ſuch divided and different Maſſes, as the Starrs and Planets of the preſent World.

But allowing our Adverſaries, that The Planets might be compoſed: yet however they could not poſſibly acquire ſuch Revolutions in Circular Orbs, or (which is all one to our preſent purpoſe) in Ellipſes very little Eccentric. For let them aſſign any place where the Planets were formed. Was it nearer to the Sun, than the preſent diſtances are? But that is notoriouſly abſurd: for then

they muſt have aſcended from the place of their Formation, againſt the eſſential property of mutual Attraction. Or were each formed in the ſame Orbs, in which they now move? But then they muſt have moved from the Point of Reſt, in an horizontal Line without any inclination or deſcent. Now there is no natural Cauſe, neither Innate Gravity nor Impulſe of external Matter, that could beget ſuch a Motion. For Gravity alone muſt have carried them downwards to the Vicinity of the Sun. And that the ambient Æther is too liquid and empty, to impell them horizontally with that prodigious celerity, we have ſufficiently proved before. Or were they made in ſome higher regions of the Heavens; and from thence deſcended by their eſſential Gravity, till they all arrived at their reſpective Orbs; each with its preſent degree of Velocity, acquired by th: fall? But then why did they not continue their deſcent, till they were contiguous to the Sun; whither both Mutual Attraction and Impetus carried them? What natural Agent could turn them aſide, could impell them ſo ſtrongly with a tranſverſe Side-blow againſt that tremendous Weight and Rapidity, when whole Worlds are a falling? But though we ſhould ſuppoſe, that by ſome croſs attraction or other they might acquire an obliquity of deſcent, ſo as to miſs the body of the Sun, and to fall on one ſide of it: then indeed the force of their Fall would carry them quite beyond

beyond it; and ſo they might fetch a compaſs about it, and then return and aſcend by the ſame ſteps and degrees of Motion and Velocity, with which they deſcended before. Such an eccentric Motion as this, much after the manner that Comets revolve about the Sun, they might poſſibly acquire by their innate principle of Gravity: but circular Revolutions in concentric Orbs about the Sun or other central Body could in no-wiſe be attain'd without the power of the Divine Arm. For the Caſe of the Planetary Motions is this. Let us conceive all the Planets to be formed or conſtituted with their Centers in their ſeveral Orbs; and at once to be impreſs'd on them this Gravitating Energy toward all other Matter, and a tranſverſe Impulſe of a juſt quantity in each, projecting them directly in Tangents to thoſe Orbs. The Compound Motion, which ariſes from this Gravitation and Projection together, deſcribes the preſent Revolutions of the Primary Planets about the Sun, and of the Secondary about Thoſe: the Gravity prohibiting, that they cannot recede from the Centers of their Motions; and the tranſverſe Impulſe with-holding, that they cannot approach to them. Now although Gravity could be innate (which we have proved that it cannot be) yet certainly this projected, this tranſverſe and violent Motion can only be aſcribed to the Right hand of the *moſt high God, Creator of Heaven and Earth.*

But finally, though we grant, that theſe Circular Revolutions could be naturally attained; or, if they will, that this very individual World in its preſent poſture and motion was actually formed out of Chaos by Mechanical Cauſes: yet it requires a Divine Power and Providence to have conſerved it ſo long in the preſent ſtate and condition. We have ſhewed, that there is a Tranſverſe Impulſe impreſs'd upon the Planets, which retains them in their ſeveral Orbs, that they be not drawn down by their gravitating Powers toward the Sun or other central Bodies. Gravity we underſtand to be a conſtant Energy or Faculty (which God hath infuſed into Matter) perpetually acting by certain Meaſures and (naturally) inviolable Laws; I ſay, a *Faculty* and Power: for we cannot conceive that the *Act* of Gravitation of this preſent Moment can propagate it ſelf or produce that of the next. But 'tis otherwiſe as to the Tranſverſe Motion; which (by reaſon of the Inactivity of Matter and its inability to change its preſent State either of Moving or Reſting) would from one ſingle Impulſe continue for ever equal and uniform, unleſs changed by the reſiſtence of occurring Bodies or by a Gravitating Power; ſo that the Planets, ſince they move Horizontally (whereby Gravity doth not affect their ſwiftneſs) and through the liquid and unreſiſting Spaces of the Heavens (where either no Bodies at all or inconſiderable ones do occur) may pre-

preſerve the ſame Velocity which the firſt Impulſe impreſt upon them, not only for five or ſix thouſand years, but many Millions of Millions. It appears then, that if there was but One Vaſt Sun in the Univerſe, and all the reſt were Planets, revolving around him in Concentric Orbs, at convenient Diſtances: ſuch a Syſtem as that would very long endure; could it but naturally have a Principle of Mutual Attraction, and be once actually put into Circular Motions. But the Frame of the preſent World hath a quite different ſtructure: here's an innumerable multitude of Fixt Starrs or Suns; all of which are demonſtrated (and ſuppoſed alſo by our Adverſaries) to have Mutual Attraction: or if they have not; even Not to have it is an equal Proof of a Divine Being, that hath ſo arbitrarily indued Matter with a Power of Gravity not eſſential to it, and hath confined its action to the Matter of its own Solar Syſtem: I ſay, all the Fixt Starrs have a principle of mutual Gravitation; and yet they are neither revolved about a common Center, nor have any Tranſverſe Impulſe nor any thing elſe to reſtrain them from approaching toward each other, as their Gravitating Powers incite them. Now what Natural Cauſe can overcome Nature it ſelf? What is it that holds and keeps them in fixed Stations and Intervals againſt an inceſſant and inherent Tendency to deſert them? Nothing could hinder, but that the Outward Starrs with their

their Syſtems of Planets muſt neceſſarily have deſcended toward the middlemoſt Syſtem of the Univerſe, whither all would be the moſt ſtrongly attracted from all parts of a Finite Space. It is evident therefore that the preſent Frame of Sun and Fixt Starrs could not poſſibly ſubſiſt without the Providence of that almighty Deity, *who ſpake*
Pſal. 148. *the word and they were made, who commanded and they were created; who hath made them Faſt for ever and ever, and hath given them a Law, which ſhall not be broken.*

(2.) And ſecondly in the Suppoſition of an *infinite* Chaos, 'tis hard indeed to determin, what would follow in this imaginary Caſe from an innate Principle of Gravity. But to haſten to a concluſion, we will grant for the preſent, that the diffuſed Matter might convene into an infinite Number of great Maſſes at great diſtances from one another, like the Starrs and Planets of this viſible part of the World. But then it is impoſſible, that the Planets ſhould naturally attain theſe circular Revolutions, either by intrinſec Gravitation or the impulſe of ambient Bodies. It is plain, here is no difference as to this; whether the World be Infinite or Finite: ſo that the ſame Arguments that we have uſed before, may be equally urged in this Suppoſition. And though we ſhould concede, that theſe Revolutions might be acquired, and that all were ſettled and conſtituted in the preſent State and Poſture of Things; yet,

yet, we ſay, the continuance of this Frame and Order for ſo long a duration as the known ages of the World muſt neceſſarily infer the Exiſtence of God. For though the Univerſe was Infinite, the Fixt Starrs could not be fixed, but would naturally convene together, and confound Syſtem with Syſtem: for, all mutually attracting, every one would move whither it was moſt powerfully drawn. This, they may ſay, is indubitable in the caſe of a Finite World, where ſome Syſtems muſt needs be Outmoſt, and therefore be drawn toward the Middle: but when Infinite Syſtems ſucceed one another through an Infinite Space, and none is either inward or outward; may not all the Syſtems be ſituated in an accurate Poiſe; and, becauſe equally attracted on all ſides, remain fixed and unmoved? But to this we reply; That unleſs the very mathematical Center of Gravity of every Syſtem be placed and fixed in the very mathematical Center of the Attractive Power of all the reſt; they cannot be evenly attracted on all ſides, but muſt preponderate ſome way or other. Now he that conſiders, what a mathematical Center is, and that Quantity is infinitly diviſible; will never be perſuaded, that ſuch an Univerſal Equilibrium ariſing from the coincidence of Infinite Centers can naturally be acquired or maintain'd. If they ſay; that upon the Suppoſition of Infinite Matter, every Syſtem would be infinitly, and therefore equally attracted on all ſides; and conſequently

ſequently would reſt in an exact Equilibrium, be the Center of its Gravity in what Poſition ſoever: This will overthrow their very Hypotheſis; at this rate in an *infinite Chaos* nothing at all could be formed; no Particles could convene by mutual Attraction; for every one there muſt have Infinite Matter around it, and therefore muſt reſt for ever being evenly balanced between Infinite Attractions. Even the Planets upon this principle muſt gravitate no more toward the Sun, than any other way: ſo that they would not revolve in curve Lines, but fly away in direct Tangents, till they ſtruck againſt other Planets or Starrs in ſome remote regions of the Infinite Space. An equal Attraction on all ſides of all Matter is juſt equal to no Attraction at all: and by this means all the Motion in the Univerſe muſt proceed from external Impulſe alone; which we have proved before to be an incompetent Cauſe for the Formation of a World.

And now, O thou almighty and eternal Creator, *having conſider'd the Heavens the work of thy*
Pſal. 8. *fingers, the Moon and the Starrs which thou haſt ordained*, with all the company of Heaven we laud and magnify thy glorious Name, evermore praiſing thee and ſaying; Holy, Holy, Holy, Lord God of Hoſts, Heaven and Earth are full of thy Glory: Glory be to thee, O Lord moſt High.

F I N I S.

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